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Okayasu

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(54) **KEY INPUT DEVICE**

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(73) Assignee: **NEC Corporation** (JP)

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(30) **Foreign Application Priority Data**

Aug. 1, 2002 (JP) 2002-225197

(51) **Int. Cl.**
G01D 11/28 (2006.01)
H04M 1/22 (2006.01)
G09G 3/36 (2006.01)

(52) **U.S. Cl.** **362/23**; 362/24; 362/85

(58) **Field of Classification Search** 362/24, 362/30, 85, 23, 800; 345/170, 169; 379/456
See application file for complete search history.

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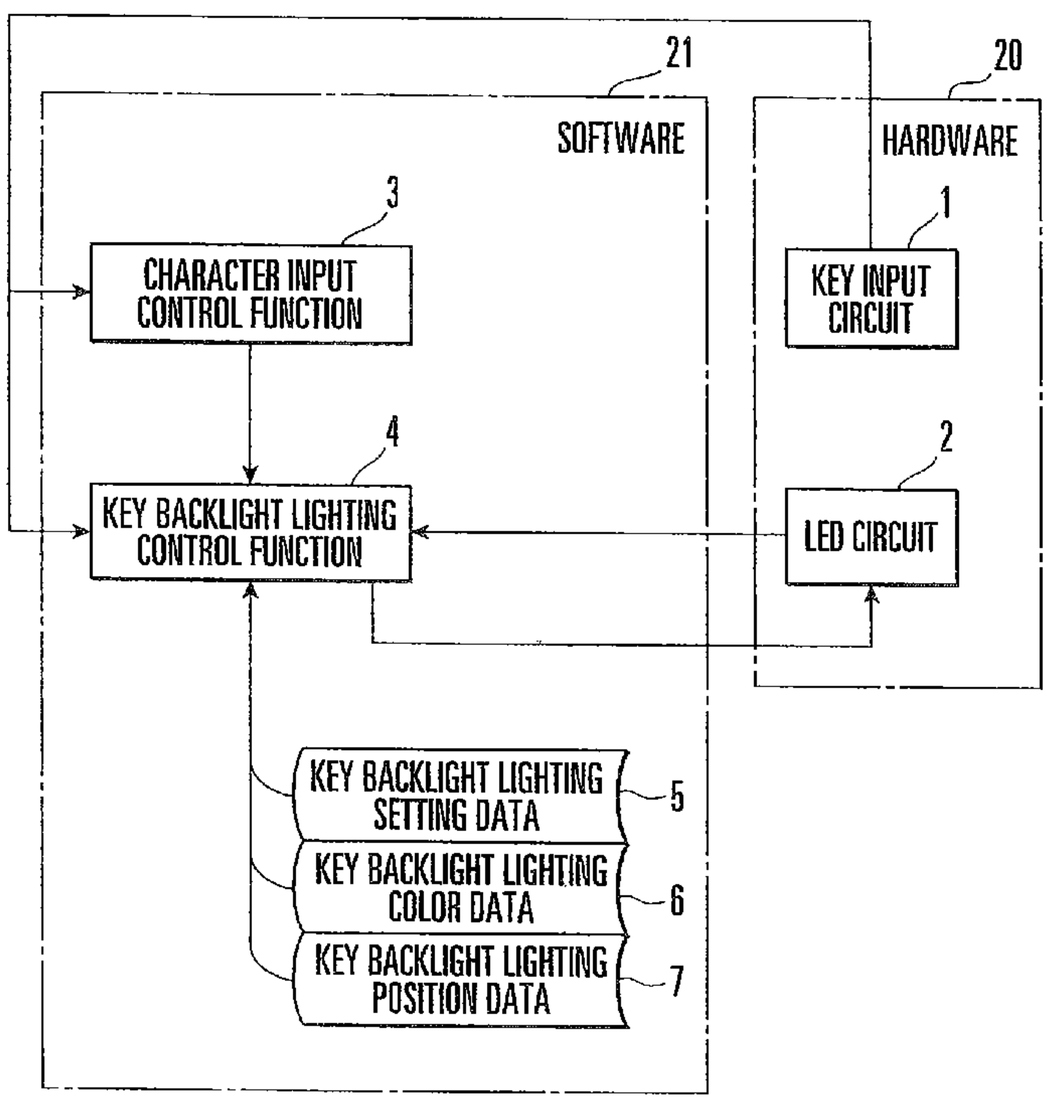
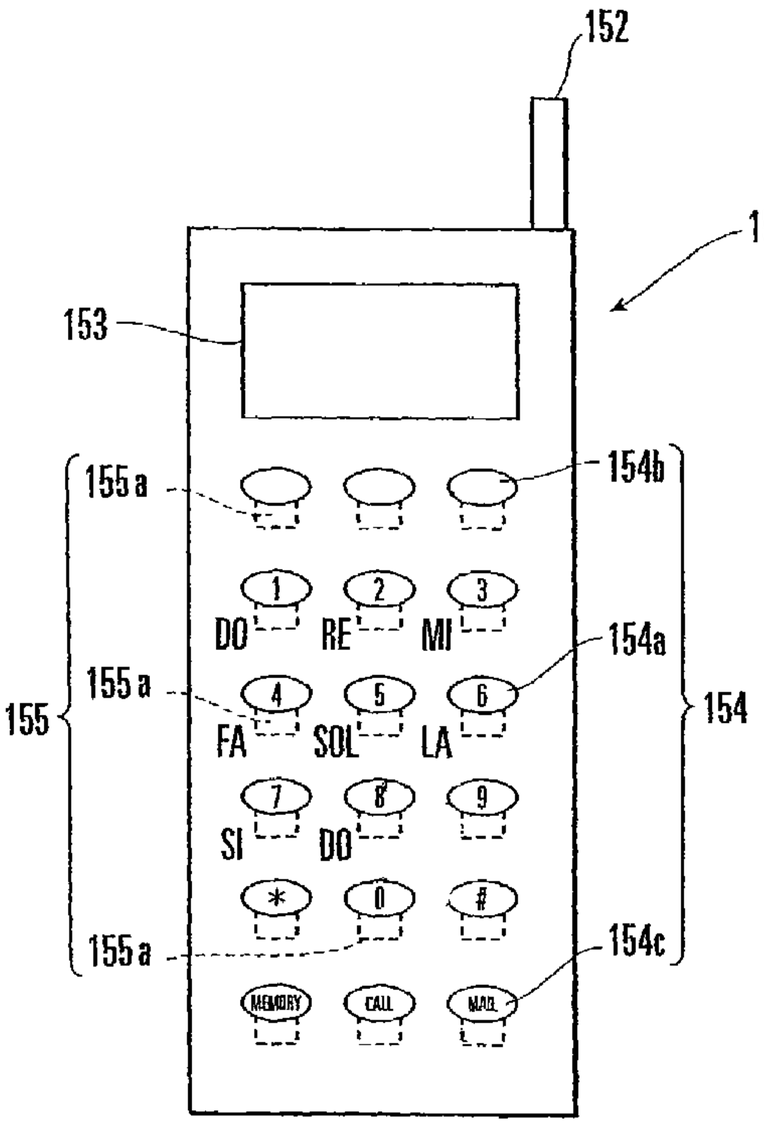
(57) **ABSTRACT**

A key input device includes a key input section, mode switching section, key backlight, and key backlight lighting control section. The key input section inputs characters by key input in a plurality of character input modes. The mode switching section switches a plurality of character input modes. The key backlight is placed on a lower surface of the key input section and is lighted in a plurality of colors. The key backlight lighting control section changes the lighting color of the key backlight in accordance with switching of character input modes. A cell phone is disclosed.

1 Claim, 7 Drawing Sheets





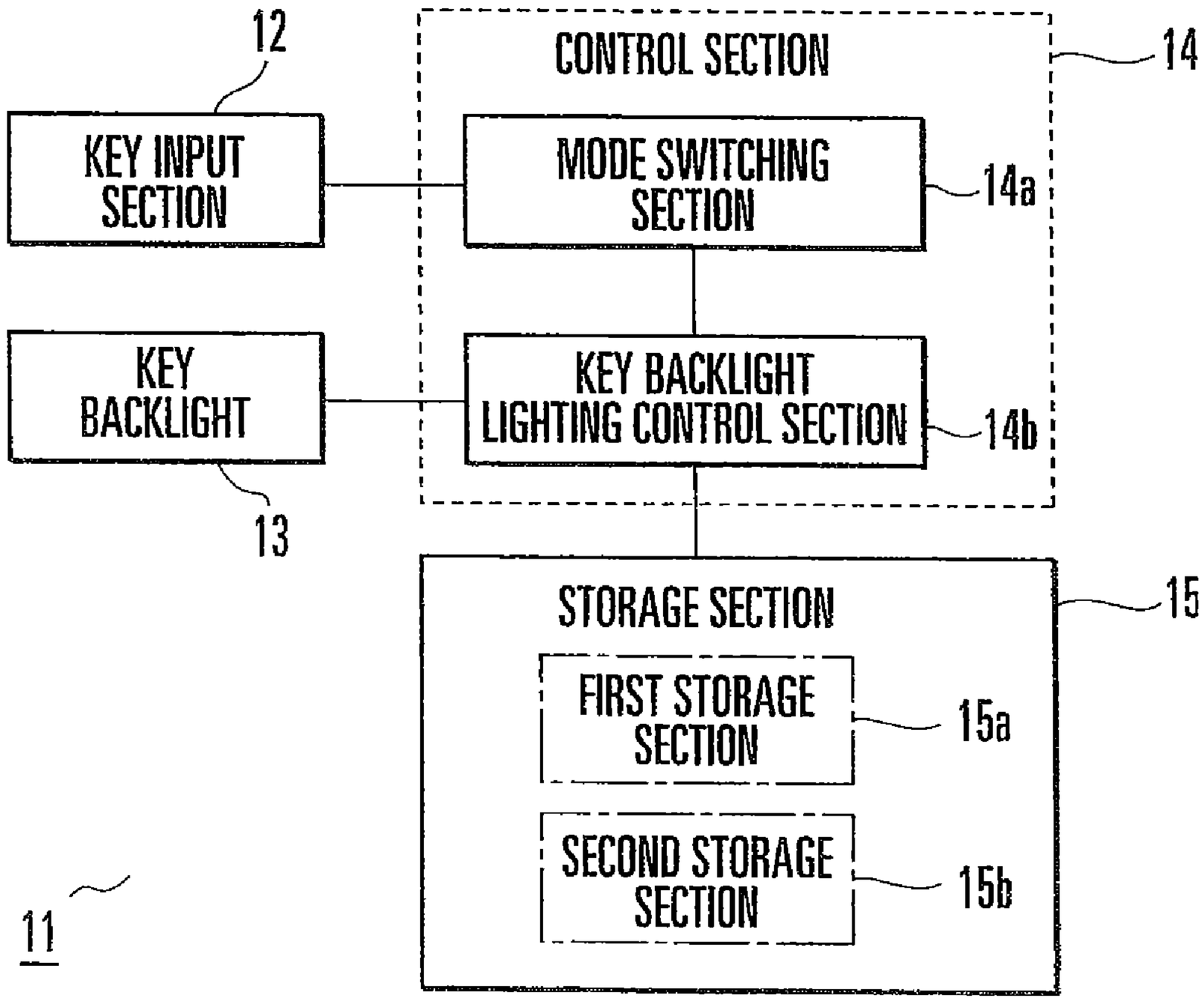

12
CONTROL SECTION
14
KEY INPUT SECTION
MODE SWITCHING SECTION
14a
KEY BACKLIGHT
KEY BACKLIGHT LIGHTING CONTROL SECTION
14b
13
STORAGE SECTION
15
FIRST STORAGE SECTION
15a
SECOND STORAGE SECTION
15b
11

FIG. 1

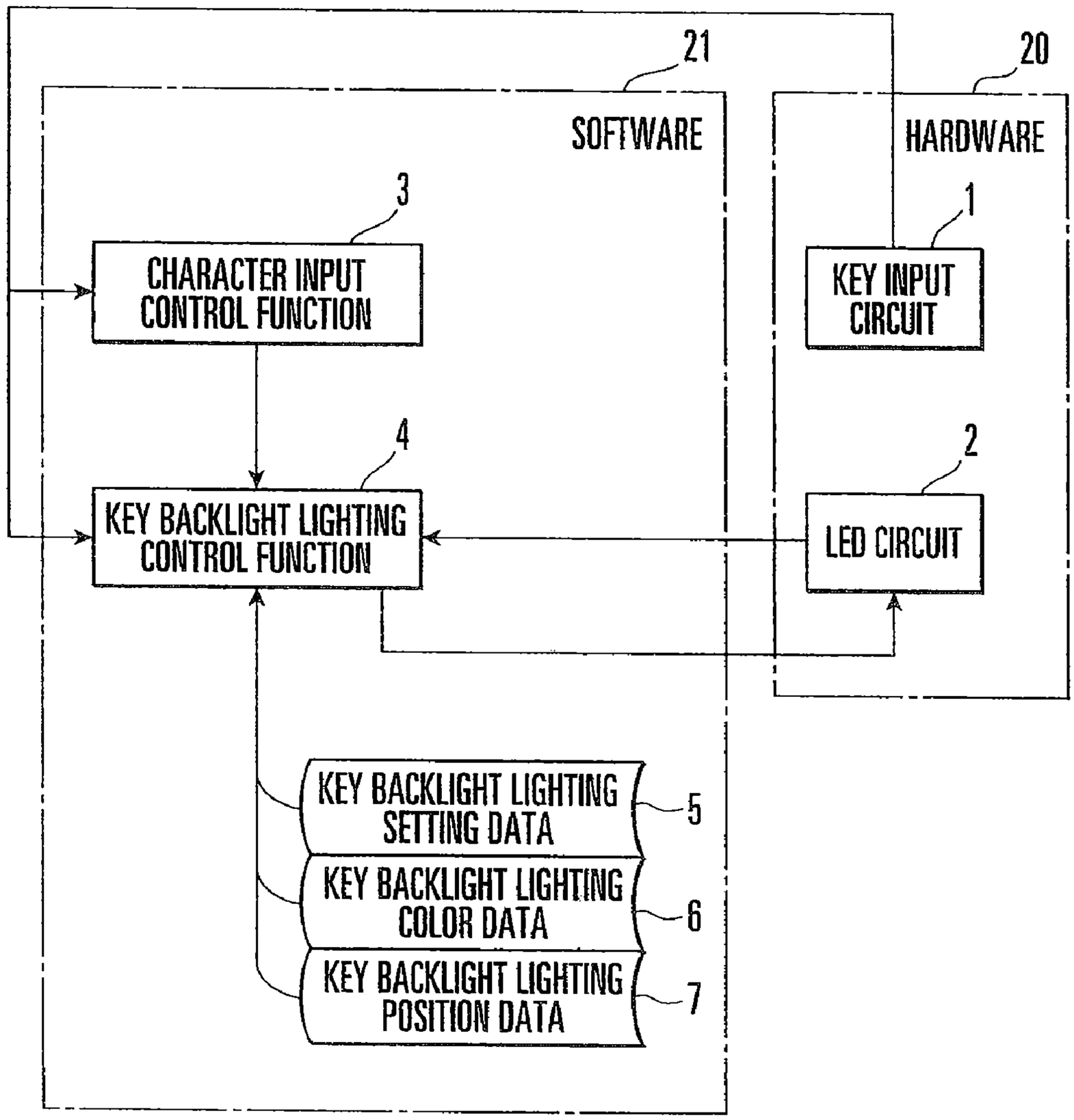

21
SOFTWARE
20
HARDWARE
3
CHARACTER INPUT CONTROL FUNCTION
1
KEY INPUT CIRCUIT
4
KEY BACKLIGHT LIGHTING CONTROL FUNCTION
2
LED CIRCUIT
KEY BACKLIGHT LIGHTING SETTING DATA
5
KEY BACKLIGHT LIGHTING COLOR DATA
6
KEY BACKLIGHT LIGHTING POSITION DATA
7

FIG. 2

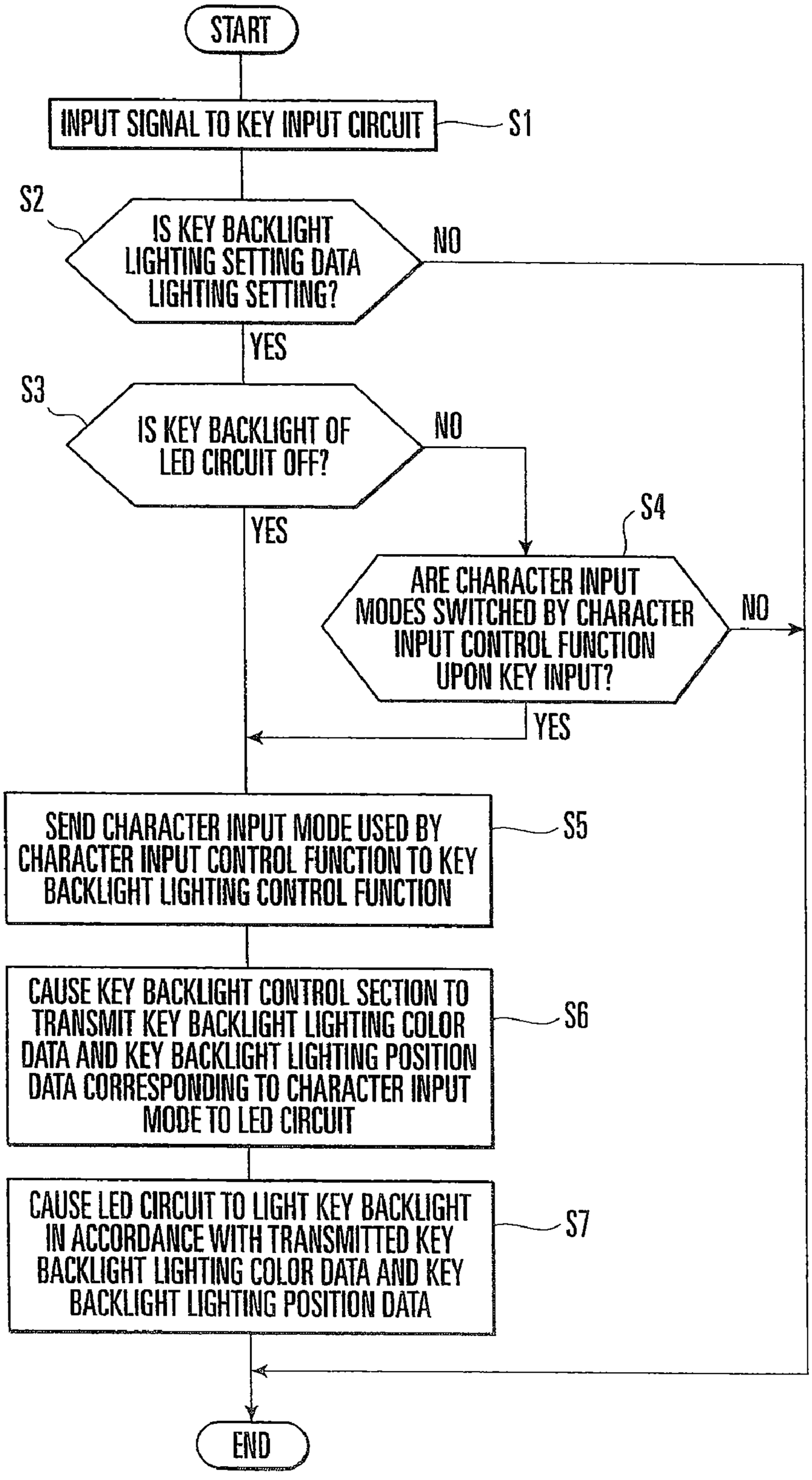

START
INPUT SIGNAL TO KEY INPUT CIRCUIT
S1
S2
IS KEY BACKLIGHT LIGHTING SETTING DATA LIGHTING SETTING?
NO
YES
S3
IS KEY BACKLIGHT OF LED CIRCUIT OFF?
NO
YES
S4
ARE CHARACTER INPUT MODES SWITCHED BY CHARACTER INPUT CONTROL FUNCTION UPON KEY INPUT?
NO
YES
SEND CHARACTER INPUT MODE USED BY CHARACTER INPUT CONTROL FUNCTION TO KEY BACKLIGHT LIGHTING CONTROL FUNCTION
S5
CAUSE KEY BACKLIGHT CONTROL SECTION TO TRANSMIT KEY BACKLIGHT LIGHTING COLOR DATA AND KEY BACKLIGHT LIGHTING POSITION DATA CORRESPONDING TO CHARACTER INPUT MODE TO LED CIRCUIT
S6
CAUSE LED CIRCUIT TO LIGHT KEY BACKLIGHT IN ACCORDANCE WITH TRANSMITTED KEY BACKLIGHT LIGHTING COLOR DATA AND KEY BACKLIGHT LIGHTING POSITION DATA
S7
END

FIG. 3

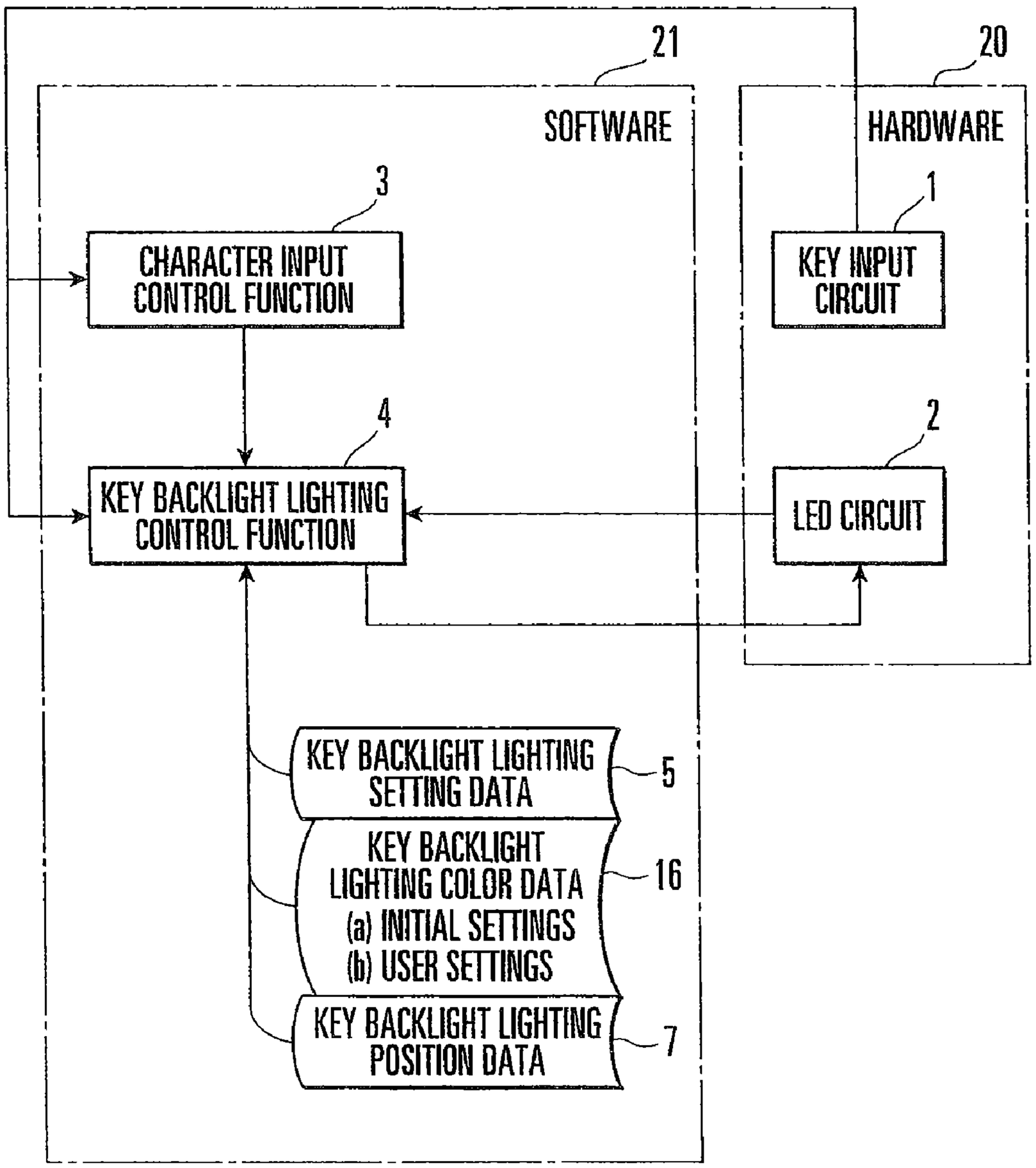

21
SOFTWARE
20
HARDWARE
3
CHARACTER INPUT CONTROL FUNCTION
1
KEY INPUT CIRCUIT
4
KEY BACKLIGHT LIGHTING CONTROL FUNCTION
2
LED CIRCUIT
KEY BACKLIGHT LIGHTING SETTING DATA
5
KEY BACKLIGHT LIGHTING COLOR DATA
(a) INITIAL SETTINGS
(b) USER SETTINGS
16
KEY BACKLIGHT LIGHTING POSITION DATA
7

FIG. 4

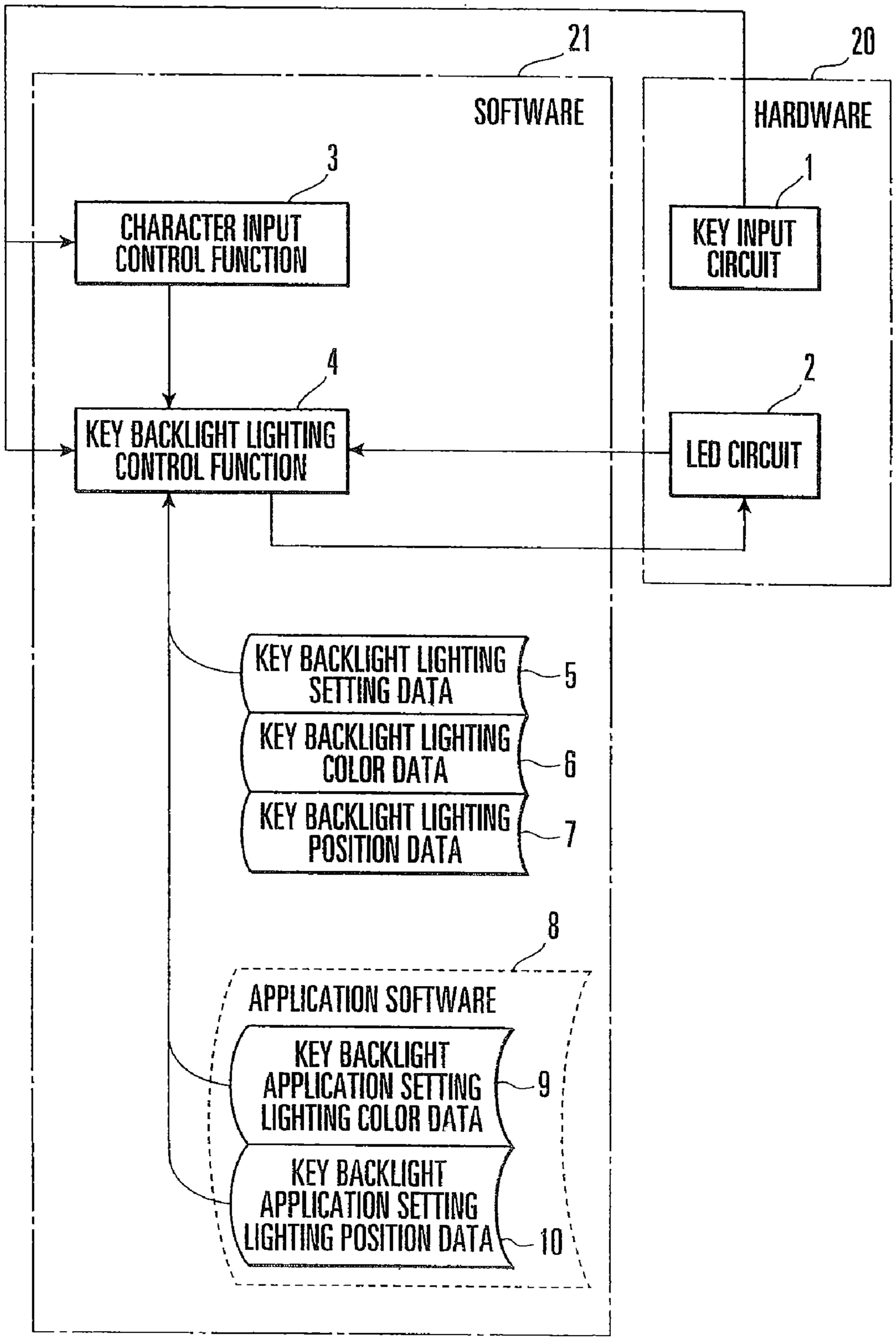

21
SOFTWARE
20
HARDWARE
3
CHARACTER INPUT CONTROL FUNCTION
1
KEY INPUT CIRCUIT
4
KEY BACKLIGHT LIGHTING CONTROL FUNCTION
2
LED CIRCUIT
KEY BACKLIGHT LIGHTING SETTING DATA
5
KEY BACKLIGHT LIGHTING COLOR DATA
6
KEY BACKLIGHT LIGHTING POSITION DATA
7
8
APPLICATION SOFTWARE
KEY BACKLIGHT APPLICATION SETTING LIGHTING COLOR DATA
9
KEY BACKLIGHT APPLICATION SETTING LIGHTING POSITION DATA
10

FIG. 5

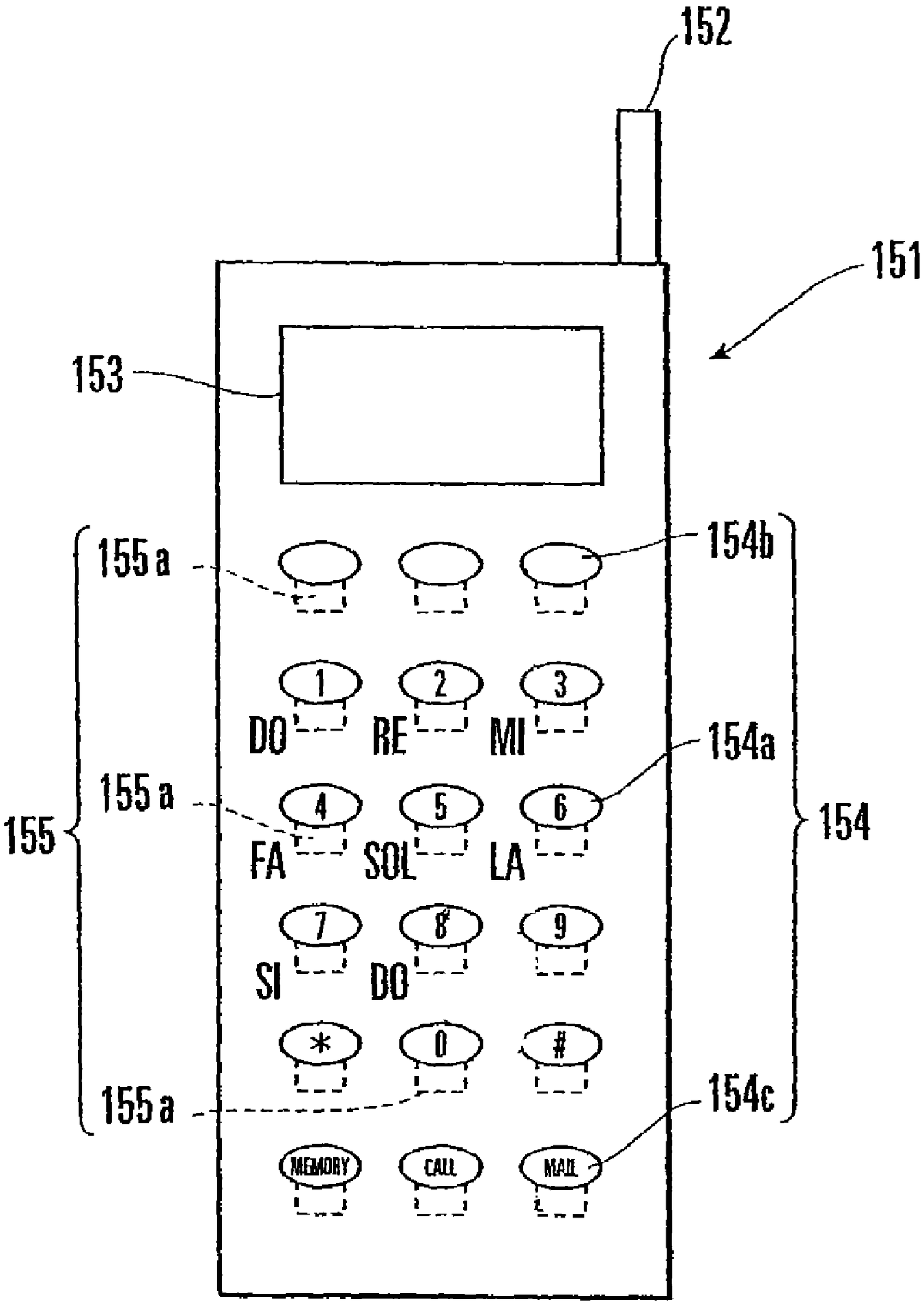

152
151
153
155 a
154b
1
2
3
DO
RE
MI
154a
155 a
4
5
6
155
FA
SOL
LA
154
7
8
9
SI
DO
*
0
#
155 a
154c
MEMORY
CALL
MAIL

FIG. 6

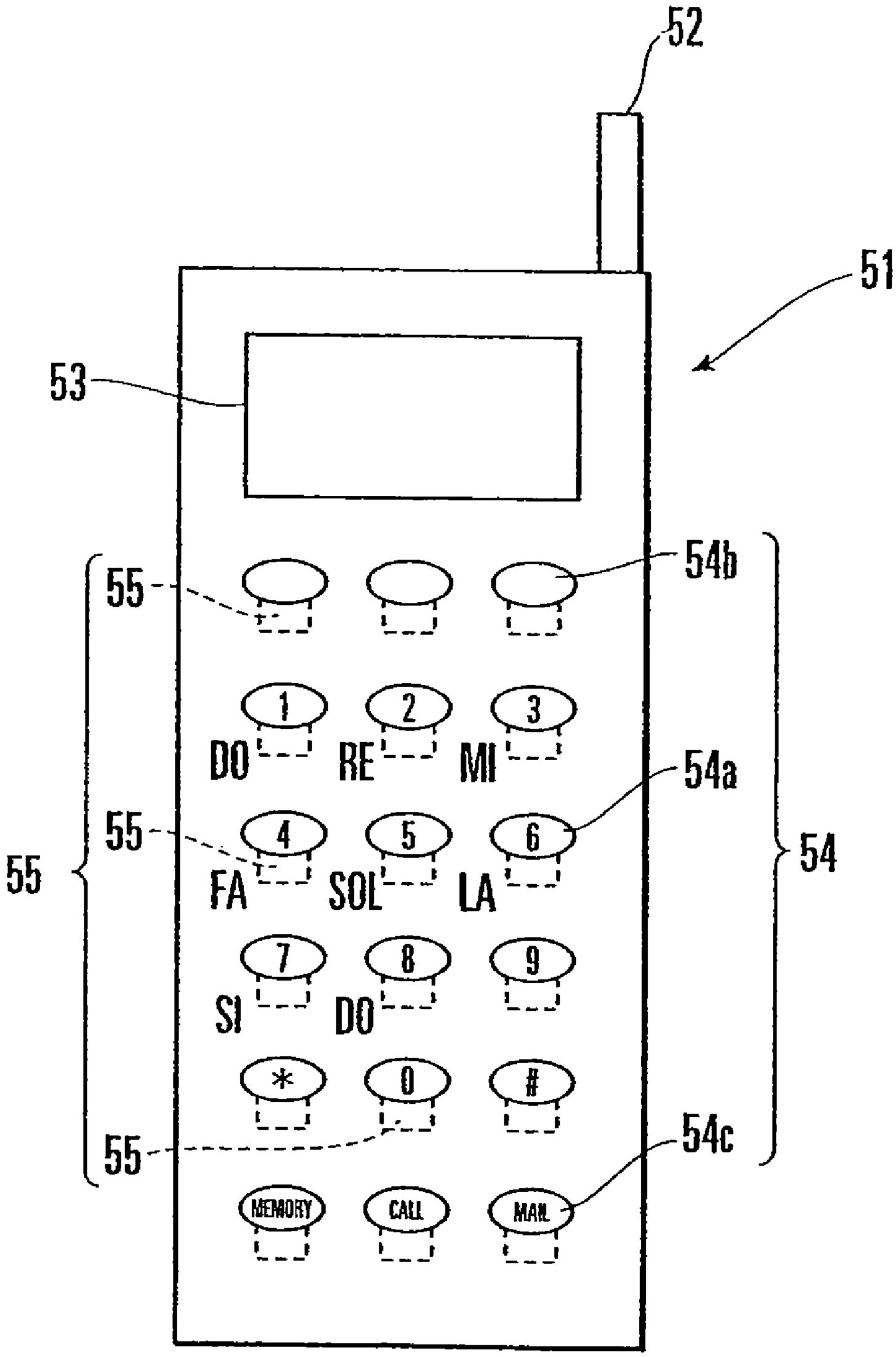


FIG. 7
RELATED ART

KEY INPUT DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

This is a divisional of U.S. patent application Ser. No. 10/631,798, filed Jul. 31, 2003 in the name of NEC Corporation and entitled KEY INPUT DEVICE.

BACKGROUND OF THE INVENTION

The present invention relates to a key backlight for a cell phone or the like having an operation key section and, more particularly, to a key input device including a light-emitting means for lighting or blinking an operation key section in different modes or colors in accordance with key operation.

In a cell phone having an operation key section constituted by a plurality of keys for operating the cell phone, e.g., inputting a telephone number or mail using characters, the keys of the operation key section are formed from a transparent or translucent material. In addition, a plurality of light-emitting portions (key backlights) are arranged on the bottom sides of these keys to light or blink the operation key section in different modes or colors in accordance with the operation of the cell phone.

Japanese Patent Laid-Open No. 2001-217904 discloses a technique of using an operation key section as a notification means and display means by utilizing the above operation.

FIG. **7** shows the outer appearance of a cell phone with an operation key section lighting function disclosed in the above reference. An operation key section **54** formed from a translucent member is comprised of a plurality of keys such as dial number keys **54***a*, a signal transmission/reception key, an on-hook key **54***b*, a mail key **54***c*, and various setting keys. The operation key section **54** also serves as an input operation means for a control section in the cell phone body.

Multicolor light-emitting portions (key backlights) **55** are arranged in correspondence with the respective keys. Each light-emitting portion is constituted by a multicolor LED or the like capable of emitting two or more different color beams. The emission mode of each multicolor light-emitting portion **55** is controlled by the control section in the cell phone body. In addition, the multicolor light-emitting portions **55** emit light beams in predetermined colors in accordance with various kinds of operation of the cell phone.

For example, musical notes are assigned in advance to the multicolor light-emitting portions **55** and the corresponding keys, and the multicolor light-emitting portions **55** are made to emit light beams in different colors in accordance with the musical notes of melody sounds generated by the melody sound generating section in the cell phone body. Alternatively, when a plurality of melodies are set, the multicolor light-emitting portions are made to emit light beams in different colors in accordance with the kinds of melodies. This makes it possible to discriminate, in accordance with an emission color, who has made a call.

In addition, when mail is received, the multicolor light-emitting portion **55** corresponding to a numeric key indicating the number of incoming calls is made to emit light in accordance with the number of received mail.

When the dial number key **54***a* lighted by the light emitted by the multicolor light-emitting portion **55** is pressed, the contents of the mail are displayed on a display section **53**.

Many functions as added values, e.g., a mail function and browser function, are added to recent cell phones.

For example, in performing mail transmission using the mail function, the user must input a mail message using keys of the operation key section of the cell phone.

The operation key section, however, has ten-odd keys at most. The user must input characters in various modes, e.g., the numeric input mode, kanji input mode, and alphabet input mode using such limited number of keys. In general, therefore, the character input modes are switched by a character input mode changing key to allow the user to input various kinds of characters by key input in a desired character input mode while checking an icon indicating a character input mode, which is displayed on a corner of the display screen.

As described above, the user must set a desired input mode while checking the currently used input mode with a small icon displayed on a corner of the display screen.

If the character input mode is changed by an input error unintended by the user, he/she tends to overlook the change in mode with such a small icon. As a consequence, the input error makes the user waste extra time creating a mail message.

SUMMARY OF THE INVENTION

It is an object of the present invention to facilitate confirmation of the currently used character input mode and allow a user to know a newly set character input mode upon occurrence of a change in character input mode, thereby improving the efficiency of character input operation through an operation key section.

In order to achieve the above object, according to the present invention, there is provided a key input device comprising key input means for inputting characters by key input in a plurality of character input modes, switching means for switching a plurality of character input modes, a key backlight which is placed on a lower surface of the key input means and is lighted in a plurality of colors, and lighting control means for changing a lighting color of the key backlight in accordance with switching of character input modes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing a key input device according to an embodiment of the present invention;

FIG. **2** is a block diagram showing the hardware arrangement and software arrangement of the key input device according to the first embodiment of the present invention;

FIG. **3** is a flow chart showing the operation of the first embodiment;

FIG. **4** is a block diagram showing the second embodiment of the present invention;

FIG. **5** is a block diagram showing the third embodiment of the present invention;

FIG. **6** is a view showing the outer appearance of a cell phone incorporating the present invention; and

FIG. **7** is a view showing the outer appearance of a conventional cell phone to which the present invention can be applied.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. **1**, a key input device **11** according to the present invention includes a key input section **12** for inputting character strings and the like and a key backlight **13** which is placed on the lower surface of the key input section and lighted in various different colors. In this case, the key input section **12** includes a plurality of keys **154***a*, **154***b*, and **154***c* (to be described later). The key backlight **13** has light-emit-

ting means **155***a* (to be described later) located on the lower surfaces of the respective keys **154***a*, **154***b*, and **154***c*.

The key input device **11** also includes a control section **14** having a mode switching section **14***a* which is connected to the key input section **12** to switch the character input modes of the key input section **12**, and a key backlight lighting control section **14***b* which changes the lighting color of the key backlight **13** in synchronism with switching of the set character input modes. The key input device **11** is connected to the key backlight lighting control section **14***b* and includes a storage section **15** having a first storage section **15***a* and second storage section **15***b*.

In the key input device **11**, the first storage section **15***a* cannot be overwritten, and the second storage section **15***b* can be overwritten.

As shown in FIG. **2**, the hardware arrangement of the key input device **11** according to the present invention is constituted by a key input circuit **1** which receives input signals upon character input operation by a user, and an LED circuit **2** which lights or blinks the key backlight. The software arrangement of the key input device **11** according to the present invention includes a character input control function **3** for controlling character input modes such as a kanji input mode, and a key backlight lighting control function **4** for controlling the lighting color and light position of the key backlight.

The data handled by the key backlight lighting control function is constituted by key backlight lighting setting data **5** for holding a setting indicating whether the key backlight is to be lighted or unlighted, key backlight lighting color data **6** for holding combinations of character input modes and lighting colors, and key backlight lighting position data **7** for holding the positions of keys that can be used for character input operation in the respective character input modes.

Software programs **21** described above are stored in the first storage section **15***a* in advance. Hardware **20** operates under the control of the software programs **21** to implement the function of each section described above.

FIG. **3** shows the operation of this embodiment. The operation of the present invention will be described below with reference to FIGS. **2** and **3**.

When a signal is input to the key input circuit **1** upon key operation (step S**1**), the key backlight lighting control function **4** refers to the key backlight lighting setting data **5** to check whether or not a setting for lighting the key backlight has been made for this key input signal (step S**2**).

If the determination result indicates an "unlighting setting" (step S**2**: NO), the processing is terminated without lighting the key backlight. If the determination result indicates a "lighting setting" (step S**2**: YES), it is checked whether or not the key backlight of the LED circuit **2** is currently OFF (step S**3**).

If the key backlight of the LED circuit **2** is currently OFF (step S**3**: YES), the character input control function **3** transfers a character input mode signal to the key backlight lighting control function **4** to prepare for lighting of the key backlight (step S**5**).

If the key backlight of the LED circuit **2** is currently ON (step S**3**: NO), the character input control function **3** checks whether character input modes have been switched (step S**4**).

If no character input modes have been switched (step S**4**: NO), the state of the key backlight is kept unchanged, and the processing is terminated.

If character input modes have been switched (step S**4**: YES), the character input control function **3** transfers a character input mode signal to the key backlight lighting control function **4** to prepare for changing of the color and lighting position of the key backlight (step S**5**).

Upon reception of the character input mode signal from the character input control function **3** in step S**5**, the key backlight lighting control function **4** refers to the key backlight lighting color data **6** and key backlight lighting position data **7** and transmits key backlight lighting color data and key backlight lighting position data corresponding to the received character input mode to the LED circuit **2** (step S**6**).

In accordance with the received backlight lighting color data and key backlight lighting position data, the LED circuit **2** lights, in designated lighting color, the backlights for keys that can be used for input operation (step S**7**).

The above embodiment has exemplified the character input modes such as the kanji input mode. In addition to them, however, a numeric input mode and the like can be set, and the device can be switched to these modes as needed. In addition, the device may be switched to an input mode based on the language spoken in the country where the device is used. For example, the device may be switched to an English input mode in an English-speaking country; a French input mode in a French-speaking country; and a German input mode in a German-speaking country. In addition, the key backlight can be lighted in many colors such as red and blue.

A specific arrangement for multicolor lighting of the key backlight can be implemented by a proper means, e.g., the multicolor light-emitting portions in the above reference. For example, red, green, and blue LEDs (light-emitting portions) are arranged as light-emitting portions. A transparent or translucent member is preferably used for each key of the key input, which is used for character input operation and the like. In this embodiment, in synchronism with a character input mode, the entire key input section or only corresponding keys that can be used for input operation are lighted by key backlights in a corresponding color. This allows the user to visually recognize, through the key backlights, the current character input mode and whether or not character input operation can be done.

In this case, the lighting color of each key backlight makes the user visually recognize the currently used character input mode and whether or not character input operation can be done. When the character input mode is changed, the lighting colors or lighting positions of key backlights are changed. If, therefore, an unintentional change in character input mode occurs, the user can recognize the change before performing key input operation. This leads to a reduction in input errors.

The second embodiment of the present invention will be described next with reference to FIG. **4**.

The second embodiment differs from the first embodiment in key backlight lighting color data **6**. A characteristic feature of this embodiment is that a user can change the combinations of character input modes and corresponding key backlight lighting colors.

The data of a combination designated by the user is stored in a storage area for user settings (b) different from a storage area for initial settings (a). For example, the initial settings (a) are stored in a first storage section **15***a*, and the user settings (b) are stored in a second storage section **15***b*.

The basic operation of a key backlight lighting control function **4** is the same as that in the first embodiment. When, however, the user settings (b) are stored, the storage area for the user settings (b) is preferentially referred to, and an LED circuit **2** is lighted in accordance with the combinations of character input modes and corresponding key backlight lighting colors which are designated by the user.

According to this embodiment, the combinations of character input modes and corresponding key backlight lighting

colors can be changed in accordance with the preferences of the user, as needed. In addition, since different storage areas are provided for the initial settings (a) and user settings (b), the initial settings are not overwritten and changed, and the user can return to the initial settings (a) as needed.

The third embodiment of the present invention will be described next with reference to FIG. **5**.

The third embodiment differs from the first embodiment in that it has application software **8**. In this embodiment, the programs created by JAVA (registered trademark) or the like are downloaded into a software section. If the downloaded application software **8** includes key backlight application setting lighting color data **9** and key backlight application setting lighting position data **10**, a key backlight lighting control function **4** refers to these data.

In this case, the key backlight application setting lighting color data **9** is data which defines combinations of character input modes and lighting colors, and the key backlight application setting lighting position data **10** is data which defines the positions of keys prepared for the respective character input modes, which can be used for character input operation. This application is stored in a second storage section **15***b*.

The key backlight lighting control function **4** refers to the key backlight application setting lighting color data **9** and key backlight application setting lighting position data **10** while the application software **8** is executed.

This operation makes it possible to perform LED control by operation similar to character input operation. As a consequence, scene changes and keys that can be used for input operation can be displayed with key backlights so as to be visually discriminated.

FIG. **6** shows cell phone incorporating the key input device according to the above embodiment. A cell phone **151** includes an antenna **152** and operation key section **154**, like the cell phone **51** described with reference to FIG. **7**. An operation key section **154** includes a plurality of keys such as dial number keys **154***a*, a signal transmission/reception key, an on-hook key **154***b*, a mail key **154***c*, and various setting keys.

The operation key section **154** also includes a multicolor light-emitting section (key backlight) **155** which is placed on the lower surface of the operation key section **154** and lighted in a plurality of colors. The multicolor light-emitting section **155** includes a plurality of light-emitting portions **155***a* provided for the respective keys. In synchronism with a character input mode, the light-emitting portions **155***a* light all the operation keys or only corresponding keys that can be used for input operation in a corresponding color.

The above embodiment has been described on the premise that the present invention is applied to the operation key section of the cell phone. However, the present invention can also be applied to other mobile terminals, personal computers, and the like which have a key input section designed to perform key input operation while switching a plurality of character input modes.

According to the present invention, the lighting color of the key backlight allows the user to visually recognize the current character input mode, whereas the lighting position of the key backlight allows the use to visually recognize each key that can be used for key input operation. This makes it possible to efficiently perform character input operation.

In addition, the user can visually recognize switching of character input modes in accordance with the lighting color of the backlight and a change in light position. This can therefore prevent the user from making an input error without noticing a change in the icon on the screen.

The features of the invention are as set forth in the paragraphs below:

1. A key input device characterized by comprising:

key input means (**12**) for inputting characters by key input in a plurality of character input modes;

switching means (**14***a*) for switching a plurality of character input modes;

a key backlight (**13**) which is placed on a lower surface of said key input means (**12**) and is lighted in a plurality of colors; and

lighting control means (**14***b*) for changing a lighting color of said key backlight (**13**) in accordance with switching of character input modes.

2. A device according to paragraph 1, wherein

said key input means (**12**) comprises a plurality of keys (**154***a*, **154***b*, **154***c*),

said key backlight (**13**) comprises light emitting means (**155***a*) located at lower surfaces of the respective keys (**154***a*, **154***b*, **154***c*), and

said lighting control means (**14***b*) changes a lighting color of only the light emitting means (**155***a*) located at the lower surface of a key which can be used for character input operation in a set character input mode.

3. A device according to paragraph 1, wherein

said device further comprises storage means (**15**) for storing correspondence data between a plurality of character input modes and a plurality of colors, and

when a signal indicating that a character input mode is switched is input from said key input means (**12**), said key backlight lighting control means (**14***b*) determines a lighting color of said key backlight (**13**) by referring to said storage means (**15**).

4. A device according to paragraph 3, wherein

said storage means (**15**) comprises first storage means (**15***a*) which cannot be overwritten, and

the correspondence data is stored as an initial setting value in the first storage means (**15***a*).

5. A device according to paragraph 4, wherein

said storage means (**15**) comprises second storage means (**15***b*) which can be overwritten, and

said key backlight lighting control means (**14***b*) writes the correspondence data as a user setting value in the second storage means (**15***b*).

6. A device according to paragraph 5, wherein said key backlight lighting control means (**14***b*) preferentially refers to a user setting value when the user setting value is stored.

7. A device according to paragraph 3, wherein

said storage means (**15**) further comprises key backlight application setting lighting color data for setting a lighting color of said key backlight, and key backlight application setting lighting position data for setting a lighting position of said key backlight, and

said key backlight lighting control means (**14***b*) determines a lighting color of said key backlight (**13**) by referring to at least one of key backlight application setting lighting color data and key backlight application setting lighting position data.

8. A device according to paragraph 7, wherein said key backlight lighting control means (**14***b*) downloads key backlight application setting lighting color data and key backlight application setting lighting position data.

9. A cell phone characterized by comprising a key input device defined in paragraph 1.

The invention claimed is:

1. A key input device comprising:

key input means for inputting characters by key input in a plurality of character input modes;

switching means for switching a plurality of character input modes;

a key backlight which is placed on a lower surface of said key input means and is lighted in a plurality of colors; and

key backlight lighting control means for changing a lighting color and a lighting position of said key backlight so that backlights are lighted for each set of keys that are usable for each character input mode of the plurality of character input modes in accordance with switching of character input modes,

said key input means comprising a plurality of keys, said key backlight comprising light-emitting means located at a lower surface of the respective keys and located below the bottom of a top surface of the respective keys when the respective keys are viewed in a direction perpendicular to the top surface of the respective keys; wherein

said device further comprises storage means for storing correspondence data between a plurality of character input modes and a plurality of colors, and

when a signal indicating that a character input mode is switched is input from said key input means, said key backlight lighting control means determines a lighting color of said key backlight by referring to said storage means;

wherein said storage means further comprises key backlight application setting lighting color data for setting a lighting color of said key backlight, and key backlight application setting lighting position data for setting a lighting position of said key backlight, and

said key backlight lighting control means determines a lighting color of said key backlight by referring to at least one of key backlight application setting lighting color data and key backlight application setting lighting position data;

and

further wherein said key backlight lighting control means is configured to obtain, from a source external to said key input device, application software including key backlight information setting lighting color data and key backlight information setting lighting position data, and is further configured to refer to at least one of the key backlight information setting lighting color data and the key backlight information setting lighting position data while the application software is being executed.

* * * * *